What is claimed is:

1. An a-C:H gate ISFET device, comprising:
a semiconductor substrate;
a gate oxide layer on the semiconductor substrate;
an a-C:H layer overlying the gate oxide layer to form an a-C:H gate;
a source/drain in the semiconductor substrate beside the a-C:H gate;
a metal wire on the source/drain; and
a sealing layer overlying the metal wire and exposing the a-C:H layer.

2. The a-C:H gate ISFET device as claimed in claim 1, wherein the length of the channel, the width of the channel and ratio of width/length of the channel of the ISFET are 50μm, 1000μm and 20, respectively.

3. The a-C:H gate ISFET device as claimed in claim 1, wherein the semiconductor substrate is p-type.

4. The a-C:H gate ISFET device as claimed in claim 1, wherein the resistivity of the semiconductor substrate ranges from 8 to 12Ω-cm.

5. The a-C:H gate ISFET device as claimed in claim 1, wherein the lattice parameter of the semiconductor is (1,0,0).

6. The a-C:H gate ISFET device as claimed in claim 1, wherein the thickness of the gate oxide layer is 1000Å.

7. The a-C:H gate ISFET device as claimed in claim 1, wherein the metal wire is Al.

8. The a-C:H gate ISFET device as claimed in claim 1, wherein the sealing layer is epoxide resin.

9. The a-C:H gate ISFET device as claimed in claim 1, wherein the source/drain is N-type.

10. A method for fabricating an a-C:H gate ISFET device, comprising steps of:

providing a semiconductor substrate;

forming an virtual gate on the semiconductor substrate to define the gate area of the ISFET;

forming a source/drain in the semiconductor substrate beside the virtual gate;

removing the virtual gate;

forming an a-C:H gate in the gate area to form a ISFET by PE-LPCVD.

11. The method as claimed in claim 10, wherein forming the virtual gate to define the gate area of the ISFET further comprises:

rinsing the semiconductor substrate;

forming a pad oxide layer on the semiconductor substrate; and

removing a portion of the oxide layer to form a virtual gate to define the gate area.

12. The method as claimed in claim 11, wherein the PE-LPCVD is performed under conditions of:

base pressure at least 10^{-6} torr;

temperature of the semiconductor substrate between 140°C and 160°C;

a mixing gas comprising methane and hydrogen at flow ratio between 6 to 10 SCCM;

the process pressure between 0.08 and 0.1 torr; and

a RF power between 145W and 160W.

13. The method as claimed in claim 10, further comprising a step of forming a gate oxide layer below the a-C:H gate in the gate area.

14. The method as claimed in claim 10, wherein forming the source/drain beside the virtual gate further comprises doping the semiconductor substrate by the virtual gate as a mask to form a source/drain.

15. The method as claimed in claim 12, wherein the ratio of the methane and hydrogen, in the mixing gas, is 30 to 70.

16. The method as claimed in claim 12, wherein the temperature of the semiconductor substrate is 150°C.

17. The method as claimed in claim 1, wherein the flow ratio of the mixing gas is 8SCCM.

18. The method as claimed in claim 1, wherein the pressure of the mixing gas of methane and hydrogen is 0.09 torr.

19. The method as claimed in claim 1, wherein the RF power is 150W.

20. A method of measuring the temperature parameters of an ISFET with an a-C:H as a detection membrane, comprising:

immersing the detection membrane in a buffer solution;

changing the pH of the buffer solution at a predetermined temperature;

measuring and recording the source-drain current and the gate voltage of the ISFET to obtain a curve;

selecting a fixed current from the curve to obtain the sensitivity of the ISFET at the predetermined temperature;

changing the temperature of the buffer solution and repeating immersion, pH change, measurement, recording and selection, to obtain the sensitivities of the ISFET at different temperatures.

21. The method as claimed in claim 20, wherein the increment of the gate voltage is caused by increasing per unit pH at the predetermined temperature.

22. The method as claimed in claim 21, wherein the predetermined temperature is fixed by a temperature controller and a heater.

23. The method as claimed in claim 22, wherein the predetermined temperature is between 5°C and 55°C.

24. The method as claimed in claim 23, wherein the pH of buffer solution is between 1 and 10.

25. An apparatus for measuring the temperature of an ISFET with a-C:H as a detection membrane, comprising:

a semiconductor substrate where the ISFET is formed, comprising a pair of sources and drains separated from each other and the detection membrane insulated from the surface of the semiconductor substrate;

a buffer solution contacting the ISFET;

a light-isolating container for the buffer solution;

a heater for the buffer solution;

a temperature controller for the solution heater;

a test fixer connected to the source and drain of the ISFET; and

a current/voltage measuring device connected to the test fixer to measure and record the source-drain current and the gate voltage of the ISFET.

26. The apparatus as claimed in claim 25, further comprising a reference electrode with one end contacting the buffer solution and the other end connected to the test fixer.

27. The apparatus as claimed in claim 26, further comprising a thermometer with one end contacting the referring solution and the other end connected to the test fixer to detect the temperature of the referring solution.

28. The apparatus as claimed in claim 25, wherein the detection membrane and the surface of the ISFET are isolated by a silicon oxide layer.

29. The apparatus as claimed in claim 25, wherein the test fixer contacts the source/drain of the ISFET through an aluminum contact plug and an aluminum wire.

30. The apparatus as claimed in claim 25, wherein the temperature controller is a PID temperature controller.

31. A method of measuring the hysteresis width of an ISFET with a-C:H as a detection membrane, comprising the steps of:

fixing the drain-source current and the drain-source voltage of the ISFET by a constant voltage/current circuit;

immersing the detection membrane in a buffer solution;

recording the gate/source output voltage of the ISFET by a voltage-time recorder; and

changing the pH of the buffer solution and repeating fixing, immersion and recording to measure the hysteresis width of the ISFET.

32. The method as claimed in claim 31, wherein the hysteresis width is the change in the gate/source output voltage from the first measuring point to the final measuring point.

33. The method as claimed in claim 31, wherein the source-drain current is fixed at $80\mu A$, and the drain-source voltage is fixed at 0.2V.

34. The method as claimed in claim 31, further comprising immersing the ISFET with a-C:H as a detection membrane in a standard solution to maintain stability prior to immersing the detection membrane in the buffer solution.

35. The method as claimed in claim 31, wherein the pH is changed from pH=6 to pH=2, to pH=6, to pH=10, and to pH=6.

36. The method as claimed in claim 35, wherein each pH level of the buffer solution is fixed for one minute.

37. A method of measuring the drift rate of an ISFET with a-C:H as detection membrane (called a-C:H ISFET), comprising:

fixing the drain/source current and the drain/source voltage of the a-C:H ISFET by a constant voltage/source circuit;

immersing the detection membrane in a buffer solution;

recording the gate/source output voltage of the a-C:H ISFET during constant period by a voltage-time recorder to obtain the drift rate of the a-C:H ISFET.

38. The method as claimed in claim 37, further comprising a step of changing the pH of the buffer

solution to measure the drift rates of the a-C:H ISFET at different pH levels.

39. The method as claimed in claim 38, wherein the drift rate is the change in the gate/source voltage per unit of time.

40. The method as claimed in claim 37, wherein the gate/source current is fixed at 80μA, and the drain-source voltage is fixed at 0.2V.

41. The method as claimed in claim 37, further comprising a step of immersing the a-C:H ISFET in a standard solution to maintain stability prior to immersing the a-C:H ISFET in the buffer solution.

42. The method as claimed in claim 37, wherein the gate/source output voltage of the a-C:H ISFET is recorded for more than twelve hours.

43. An apparatus of measuring the hysteresis width and the drift rate, comprising:

an a-C:H ISFET formed on a semiconductor substrate, comprising a pair of source/drain regions within the semiconductor and a detection membrane of a-C:H isolated from the surface of the semiconductor substrate;

a buffer solution for receiving the a-C:H ISFET;

a light-isolation container for isolating light and carrying buffer solution and the a-C:H ISFET;

a heater for heating the buffer solution;

a constant current/voltage circuit coupled to the source and drain of the a-C:H ISFET to fix the drain/source current and the drain/source voltage of the a-C:H ISFET;

a current/voltage measuring device coupled to the constant current/voltage circuit; and

a voltage-time recorder coupled to the constant current/voltage circuit to record the gate/source output voltage of the a-C:H ISFET.

44. The apparatus as claimed in claim 43, further comprising a reference electrode with one end immersed in the buffer and the other end connected to the constant voltage/current circuit.

45. The apparatus as claimed in claim 44, further comprising a thermometer with one end immersed in the buffer solution and the other end coupled to a temperature controller.

46. The apparatus as claimed in claim 45, wherein the temperature controller fixes the temperature of the buffer solution at 25°C.

47. The apparatus as claimed in claim 46, wherein the constant voltage/current circuit is a negative feedback circuit.

48. The apparatus as claimed in claim 47, wherein the current/voltage measuring device comprises digital multimeters.

49. The apparatus as claimed in claim 48, wherein the constant voltage/current circuit is connected to the source/drain of the a-C:H ISFET by an aluminum contact plug and an aluminum wire.